Spinehealth and Disease

Neurological Compromise

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Neurological Diagnosis: Timing and Significance

The capacity of the spinal cord to recover from compressive injures is limited. A timely diagnosis is critical and positively influences outcome. Peripheral nerves and spinal nerve root have a greater potential for repair and recovery than the spinal cord. Bone and muscle have a broader therapeutic window than spinal nerves and peripheral nerves. If a compressed spinal nerve or peripheral nerve is decompressed before permanent injury has occurred, the nerve will begin to recover immediately when the microcirculation and blood flow is returned to the nerve. However, spinal cord tissues respond and recover very differently. In cases of rapid onset compression, the spinal cord may undergo very little recovery after relief from compression.

Surgical approaches performed to decompress the spinal cord may help prevent further neurological compromise but may still not allow for full recovery. The spinal cord has a greater potential for recovering in younger individuals. Spinal cord recovery occurs very slowly, often taking a year or two or more before the level of deficit is considered permanent. Individuals who have other existing conditions such as heart disease, peripheral artery disease and diabetes, are less likely to have the same pattern of neurological recovery as someone in better health.

The use of advanced imaging such as MRI or CT may reveal risk for spinal cord compromise or actual compression of the spinal cord in the absence of signs and symptoms. An MRI study may reveal abnormal signal changes within the compressed area of the spinal cord. Theses changes may represent ischemic or inflammatory compromise of nerve fibers. In this case, neurosurgical consultation is typically warranted. If a CT or MRI study confirms displacement and/or compression of a spinal nerve in the absence of associated signs or symptoms, surgical consultation is rarely warranted. A watch and wait approach in conjunction with conservative treatment would be appropriate.

Timing: Nerve Damage and Muscle Atrophy

Within 1-2 hours after a nerve becomes significantly compromised, degenerative changes within the nerve can be observed on microscopic studies. Within 24-48 hours, fibroblasts begin to proliferate at the site of injury. Early degeneration at nerve connections (synapses) can be identified as early as 24â€‘48 hours after nerve compromise. Within approximately 5-10 days after a muscle loses its nerve connection, muscle fiber atrophy begins to develop. After 4 months without its nerve supply, the muscle and muscle fibers begins to degenerate. Once muscle fibers degenerate full recovery of the muscle may not occur.

Recovery and Repair of Nerves in the Spinal Cord

There are many potential causes of neurological compromise in the spine that include: inflammation, compression, blunt or concussive trauma, stretch, or a lack of blood supply (ischemia). The first symptoms of mild neurological compromise are often intermittent and are usually characterized by a disturbance in sensation. Unusual sensations are often referred to as paresthesia, although the term is currently used to describe numbness and/or tingling. The symptoms associated with more severe nerve compromise are generally characterized by persistent and more intense symptoms. Continued progression of neurological compromise leads to varying degrees of muscle weakness. The presence of pain, numbness, tingling, weakness, or loss of normal function, should cause an individual to seek medical attention. The primary goal of the initial evaluation is to determine the location and cause of the neurological compromise. The workup will also serve to identify the cause of the symptoms.

The Potential for Neurological Recovery:

Peripheral and spinal nerves have the capacity to recover from injury and regain function when treated early enough. For this reason, it is always important that a timely workup be performed to identify the location and source of neurological compromise, so that an appropriate treatment plan can be implemented to promote full neurological recovery. Beyond a certain time frame injured nerves have less potential for full or even partial recovery.

Spinal nerve roots are organized in a very unique fashion, similar to the wires on the inside of a conduit. A spinal nerve is essentially a conduit of multiple nerve fibers, which traverse through it. It is not really â€œone nerve.â€?

Nerve Damage and Scarring*:*

The surroundings of an injured nerve influence the pattern of recovery. Inflammation around a nerve can lead to the formation of scar or adhesions, which can adhere to the nerve and restrict its movement. Recurrent tugging and pulling of a spinal nerve and adjacent tissue can lead to the release of inflammatory chemicals referred to as bradykinins, which cause swelling and inflammation. The presence of high concentrations of inflammatory chemicals can alter the structural, chemical and electrical properties of the nerve. Chemically induced neurological compromise responds quicker to therapeutic intervention than structural damage. Physical alteration of a spinal nerve takes longer to recover than uncomplicated inflammation. Persistent pressure mechanically deforms the spinal nerve leading to reduction of its blood supply causing inflammation. This results in altered signal

transmission leading to symptoms such as pain, numbness, or weakness. Once the pressure is removed from the nerve, the nerve is no longer physically deformed and its blood supply returns, allowing for recovery to occur.

One of the most problematic aspects of nerve compression is the development of the scar tissue or â€œfibrosis.â€? The term fibrosis describes a chain of events, which occurs as a result of activation of specialized cells referred to as fibrocytes. These cells produce scar (fibrous) tissue. The normal purpose of these specialized cells is to migrate to a region of injury and produce replacement tissue, which helps seal the area to provide stability and facilitate recovery. Over activation or chronic stimulation of fibrocytes can lead to excessive scar tissue development. This dynamic process is referred to as fibroproliferation. When this occurs within or around an injured nerve it can reduce the potential for neurological recovery.

Spinal nerves normally move (glide) within the central spinal canal and through the openings along the side of the spine (neuroforamen) during extremity and other bodily movements. If there is a scar tissue adhering to the nerve, extremity movements will lead to deleterious tugging and stretching of nerve tissue causing symptoms.